which are combined in the apparatus indicated in the diagrams, fig. 6 and fig. 7, *c*, a boiler, from which proceeds the circulating pipe, *s s*, placed beneath the floor of the room in a nearly horizontal direction, but with a general inclination from the highest point towards the boiler, *c*. The fresh air is admitted at *n*, and descends in the vertical channel, *a*, into the space beneath the floor, and coming in contact with the heated pipes, is emitted through holes in the floor into the room, and the effete air escapes by the opening, *i*, in the ceiling. This is a very favourable disposition of the heating surface, and one that is often adopted in drying-houses: one of which is shewn in the figure.

Fig. 6.

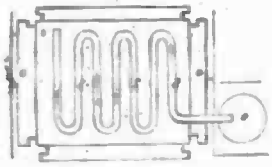
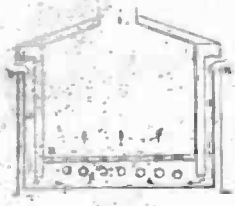


Fig. 7.

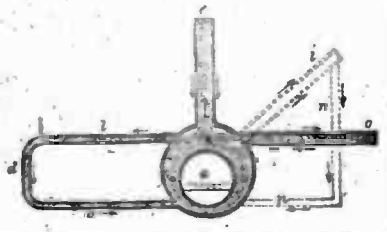


It is apparent that a similar series of pipes may be placed in a basement-chamber, from which channels may branch to the rooms which are to be heated in the floors above.

In all the apparatus which have been described, the circulation of the water is promoted by what is technically called a return or descending pipe. But in many cases, in which the difference of level is small, the effect does not appear to have been improved by this arrangement.

In the diagram, fig. 8, *a*, is a furnace in the inside of the boiler, *s*, with various pipes proceeding from it. If we suppose the pipe, *e*,

Fig. 8.

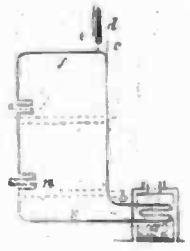


only to be attached to it, and filled with water, as that in the boiler was heated, a circulation would commence and continue by the hottest water rising to the upper part of the pipe, and the water cooled by contact with its surface falling into the boiler. It is clear the same effect will be produced if the pipe *i* were substituted for the pipe *e*; and it is also clear that the circulation would be less impeded than if the hottest water rose to *i*, and descended when cooled through the pipe, *n n*, to the bottom of the boiler, *s*, supposing in both cases an equal quantity of heat to be dissipated. If the heating pipe, *o*, was nearly horizontal, the same effect would take place from the molecular action, the water in the pipe would be somewhat warmer than if it flowed along *b*, descended by *d*, and returned by *e* into the boiler, as less of the velocity due to the temperature would be lost from friction in the straight pipe than in the return-pipe. In most cases, the return-pipe might be altogether omitted, with manifest advantage to the simplification and consequent certainty of the circulating process, the lightest water will always find the highest level, and the less it is impeded the circulation will be the more perfect, and the heating effect will be greater. The arrangement, for instance, would have been as effective had there been no return-pipe; each floor or room might have been heated by a separate pipe proceeding from the boiler, and the expense been considerably less by the simpler method.

There are two ingenious devices for continuing a circulation in cases where there is a small difference of level—the rotary float of Mr. Eckstein, and the syphon apparatus of Mr. Kewley. In some instances they are effective; but perhaps the cases where their use is necessary are not those in which hot-water heating is the most proper; they require more attention than can at all times be had from domestic servants, and are easily deranged.

The high-pressure method, contrived by Mr. Perkins, is shewn in the diagram, fig. 9. A coil of wrought-iron pipe of small diameter placed in a furnace, *a*, is continued and conducted through the building, and the necessary quantity of surface is given by forming coils, *n*, of the pipe which are placed in the rooms to be heated, and the pipe is finally returned, as at *s*, into the furnace, where it is joined to the coiled pipe, *a*, and thus forms an endless pipe. At the highest point of the heating pipe, *f*, in another pipe, *d*, of a larger diameter, placed either in a vertical or horizontal position, and which has a capacity from $\frac{1}{20}$ to $\frac{1}{17}$ of all the water in the endless pipe. This is called the expansion-pipe, and into which the water rises as it expands in heating to prevent the apparatus bursting. The filling-pipe, *o*, rises to the level, and no higher, of the lower part of the expansion or safety-pipe.

Fig. 9.



The tubes being thus arranged, the whole series, except the expansion-pipe, is filled with water by means of a force pump applied to the filling-pipe, *o*; and as it is of importance to free the endless-pipe thoroughly from air, the water is pumped several times through the tube until it is accomplished. The endless-pipe being thus filled with water, and the expansion-pipe empty, every part of the apparatus is then strongly and hermetically closed. The endless-pipe, having a bore of about $\frac{1}{4}$ an inch, and being $\frac{1}{4}$ of an inch thick, the apparatus is capable of sustaining a very great pressure.

Its action is the same as that of the chicken-stove of M. Bonnemain. The water heated in the furnace-coil rises into the upright pipe, and then flows on a declination towards the coils placed in the apartments, and gradually giving out its warmth to the air of the spaces it flows through, returns, greatly reduced in temperature, through the pipe, *s*, into the lower part of the furnace-coil, to be heated and rise upward again continually; the difference in temperature between the ascending and descending columns producing a continuous circulation throughout the apparatus.

From the manner in which the pipes are closed from the air and placed in the furnace, the water they contain may be raised to a very high temperature. Mr. Perkins states the average at about 350°, but in practice it has been observed this is considerably exceeded.

The three following diagrams will give some idea of the way in which the furnace was constructed to heat a portion of the British Museum: fig. 10 is a plan of the furnace taken above the grate; fig. 11 a longitudinal section taken through the centre of the furnace; and fig. 12 a section, supposing the front wall of the furnace to be removed; *r r*, a wall of common bricks, 9 inches thick, which incloses the furnace on its four sides; *b b*, a wall 9 inches thick, formed of Welch fire-lumps, that inclose the fire-chamber on three sides. From the face and ends of this wall fire-bricks project, to support the coiled pipe, *o*, placed in the flue. The intention of this wall is to prevent the too rapid abstraction, by the coil, of the heat from the fire which thus comes in contact with it at the opening in front only, where the hot gases turn into the back and side flues in which three-fourths of the furnace or boiler-coil is placed. The roof of the furnace is formed of Welsh lumps, in which is an opening, *m*, fitted with a moveable cover, for supplying the furnace with fuel (coke or anthracite coal being preferred). The ash-pit, *o*, is inclosed with a door, *n*, in which there is a register, *k*, double fire-door to an opening in the wall, for clearing the fire-place and furnace-bars from dust and scoria. This has a dead plate to separate the ash-pit from the heating flues; *x*, heating-pipe, rising from the boiler-coil, which passes round the internal wall in the flue, *r*, and is thus defended from the radiant heat of the fuel on all sides but one. This heating-pipe is continued from the upper part of the fire-chamber into the building; *z*, the return-pipe which enters the lower part of the furnace, and passes through the bearing bars of the fire-grating, to prevent their overheating. The dust and soot fall to the bottom of the heating flue, and prevent the coil being clogged.

Fig. 10.

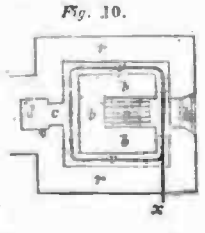


Fig. 11.

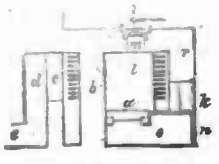
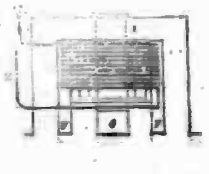


Fig. 12.



The furnace is placed in a vault in the basement-story, and the pipes, *x z*, are carried up to a height of 40 feet in a flue to two coils of pipe; one containing about 300 feet of pipe, and the other 400; about 140 feet being used for the ascending and descending pipe in the flue, and 150 in the furnace for the coil-boiler. The room containing 360 feet of pipe is 43 feet long and 30 wide, and lighted by large sky-lights in the ceiling, is raised in winter to 65°, which is a high temperature to be maintained in a room on this construction, even with this liberal allowance of heating surface.

Mr. Perkins made several skilful arrangements of his pipes in adapting his apparatus to different situations. In one example he substituted a series of pipes for a cockle, with excellent effect. The pipes were arranged in an inclosed chamber, from the roof of which channels branched to the several points that required heating, and cold air was admitted into this chamber through perforations in its floor (similar to that shewn in fig. 6), which was thus brought in contact with the hot pipes, and rose in a warm stream into the building; a disposition perhaps the most favourable that could be practised with such highly-heated surfaces, as the hot air could be properly attempered by the cold air drawn from an underground culvert about 300 yards long, before its admission into the building.—*Bernan's History and Art of Warming and Ventilating Rooms and Buildings.*

Salisbury and Winchester Cathedrals.—The points which rivet our attention when surveying the cathedrals of Salisbury and Winchester are so essentially different, that we are induced to place them in juxtaposition. At the first glance at the exterior of the former, we are delighted with its elegant lightness, the appropriateness of its ornaments, and its perfect uniformity of design, whilst we gaze with mixed feelings of awe and adoration on its "heaven-directed spire;" but when we view—steadily, view—the exterior of the latter, though it command not all those pleasurable emotions, we are struck by its solemn grandeur, its vastness of extent, and its immovable solidity. When we enter the nave of Salisbury, we are still pleased with its elegance and grace, and wonder how the slender shafts of its columns sustain its massive roof; but the flood of light poured in destroys those sensations of sublimity which the darker nave of Winchester, with its ponderous pillars, admirably sustain. Salisbury Cathedral must be taken as a whole: Winchester Cathedral must be examined in its several parts. If the exterior of the one delights and charms us, the interior of the other commands our admiration and reverence. Salisbury appears as if it had sprung into existence at the touch of the wand of some mighty magician, as perfect and as beautiful as it now appears to an enraptured eye; Winchester, on the contrary, bears on its brow the marks of age, and presents to the antiquarian the most perfect specimens of the growth of the pointed style, from the period of unadorned simplicity, till at last it became encumbered, nay buried, beneath heaps of ornaments.—*Wiltshire Independent.*

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